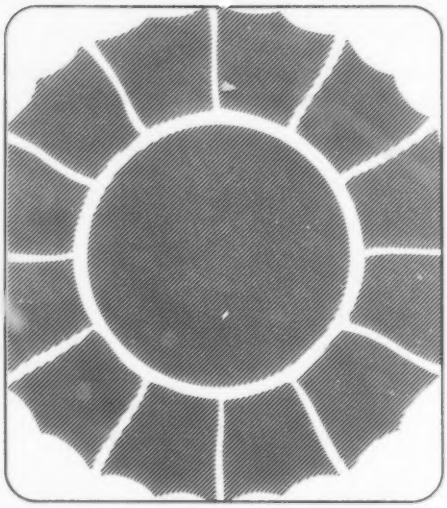
Canadian Centre for Occupational Health and Safety

Centre canadien d'hygiène et de sécurité au travail



SUNLIGHT AND SKIN CANCER

The Occupational Health Concern

P90-11E

by
James A. Baxter

93-00650/

SUNLIGHT AND SKIN CANCER
The Occupational Health Concern

CCOHS NUMBER P90-11E

ISBN 0-660-13619-8

DSS CATALOGUE NUMBER CC273-2/90-11E

Published 1990

250 Main Street East
Hamilton, Ontario L8N 1H6

(416) 572-2981

FAX 416-572-2206

Price:

Canada $3.00(Cdn)

US $3.50(US)

Other $4.00(US)

Prices subject to change without notice.

This publication was prepared as a source of general information for health and safety committees and others with an interest in understanding and reducing the occupational risk of skin cancer from exposure to sunlight.

Each publication produced by CCOHS undergoes several stages of review. As part of this review, representatives from government, employers, and labour are requested to comment on draft copies of CCOHS documents for technical accuracy and readability.

Although every effort is made to ensure accuracy and completeness of the information, it is understood that CCOHS makes no warranty as to the accuracy or completeness of such information and assumes no liability for any damages or loss suffered as a result of any inaccuracy or incompleteness therein.

The Centre encourages the widest possible distribution of this material. While this publication is protected by copyright, permission for non-commercial copying will be provided by calling 1-800-263-8466.

Cette publication est offerte en français sous le titre : Soleil et cancer de la peau - Risques sur le pla professionnel.

by
James A. Baxter
Canadian Centre for Occupational Health and Safety

TABLE OF CONTENTS

1. **Introduction**

2. **How does Sunlight Affect the Skin?**

   Sunburn
   Increased Aging of Skin
   Skin Cancer

3. **What Types of Skin Cancer are Linked to Sunlight Exposure?**

   Basal Cell Cancer
   Squamous Cell Cancer
   Malignant Melanoma

4. **What Factors Affect a Person's Risk?**

   Skin Pigment and Ability to Tan
   Heredity
   Exposure to Chemicals
   Amount of Exposure to Sunlight

5. **What Workers are at Risk?**

6. **How can the Risk of Skin Cancer from Sunlight be reduced?**

   Reducing Exposure
   Wearing Protective Clothing
   Using Protective Sunscreens
   Examining Skin Regularly

7. **Conclusion**

Further Reading

Other CCOHS Publications Dealing with Occupational Diseases

1. INTRODUCTION

Skin cancer is the most common form of cancer. Fortunately, most cases are easily cured without serious consequences. Rarely, the condition can be life-threatening if not caught in time.

Several agents in the workplace can cause skin cancer. These include long-term exposure to:

- arsenic
- chemicals from coal tar, pitch, or related products
- ionizing radiation such as x-rays
- sunlight and other sources of ultraviolet radiation

Sunlight is a leading cause of skin injury and skin cancer. The skin damaging effects of sunlight are a concern for people who work outdoors. This publication summarizes how sunlight can damage the skin and increase the risk of skin cancer. It also outlines precautions to prevent hazardous exposure.

2. HOW DOES SUNLIGHT AFFECT THE SKIN?

There are many different types of radiation in sunlight. These include visible light, which gives us the colours we see, and infrared radiation which gives us the warmth we feel. Except in extreme situations, neither visible light nor infrared radiation from sunlight causes health problems. However, sunlight also contains ultraviolet (UV) radiation which can cause harmful effects to the skin.

There are three basic types of ultraviolet radiation:

- long-wave UV or UVA
- sunburn UV or UVB
- short-wave UV or UVC

Table 1 summarizes the general features of each type.

When ultraviolet radiation reaches the skin, some radiation is reflected away from the surface. The remaining radiation is scattered into the tissues just beneath the skin's surface. A fraction of this radiation is absorbed by the skin's living cells.

Ultraviolet radiation absorbed by living cells damages sensitive substances that influence the skin's normal growth and appearance.

Table 1 - **Types of Ultraviolet Radiation and their Features**

Ultraviolet Radiation Type	General Features
ultraviolet A radiation (long-wave UV)	• not filtered out in the atmosphere • passes through galss • produces some tanning • once considered harmless but now believed harmful over the long term
ultraviolet B radiation (sunburn radiation)	• some is filtered out in the atmosphere by the ozone layer • does not pass through glass • causes sunburn, tanning, wrinkling, aging of the skin, and skin cancer
ultraviolet C radiation (short-wave UV)	• filtered out in the atmosphere by the ozone layer before reaching the earth • major artificial sources are germicidal lamps • burns the skin and causes skin cancer

Damage can result in:

- sunburn
- increased aging of the skin
- skin cancer

Sunburn

Sunburn is the familiar, immediate effect of ultraviolet radiation on the skin. It is an inflammation caused by an increase in the flow of blood beneath the skin. The reaction may not show up at once, but reaches a bright red colour within 15 to 20 hours. The condition can be very painful and sometimes causes peeling of the skin. For people who are not accustomed to strong sunlight, brief intense exposure can cause severe sunburn. There is evidence that this type of sunburn might be linked to serious forms of skin cancer later in life.

Increased Aging of Skin

Repeated exposure to the sun's ultraviolet radiation eventually causes skin damage usually associated with the aging process. Patches of skin become thin and less elastic, and develop blemishes, sun freckles, and wrinkles. These changes may take 20 years of exposure, but when they occur, the damage is irreversible. Even though these changes cannot be reversed, it is still worthwhile to take precautions to prevent further damage.

Skin Cancer

If excessive exposure to sunlight continues for several years, the damaged skin has an increased chance of developing skin cancer.

The following facts link sunlight exposure to skin cancer:

- Most skin cancer occurs in areas of skin most heavily exposed to sunlight.
- Skin cancer among people who are sensitive to sunlight is more common in regions with stronger sunlight.
- Skin cancer is more common among people who spend more time outdoors than among those who stay mostly indoors.
- People with genetic diseases that make them more sensitive to sunlight have a greater chance of developing skin cancer.
- Studies show that ultraviolet radiation similar to sunlight causes skin cancer in animals.

3. WHAT TYPES OF SKIN CANCER ARE LINKED TO SUNLIGHT EXPOSURE?

Three different types of skin cancer are linked to sunlight exposure:

- basal cell cancer
- squamous cell cancer
- malignant melanoma

Basal Cell Cancer

Basal cell cancer is the most common of all cancers in North America and Europe. It is usually found in areas of the skin exposed to sunlight, but sometimes occurs in other areas as well. It commonly, but not always, develops in areas of sun-damaged skin. This type of skin cancer appears as a raised, hard, red or red-grey, pearly wound on the forehead, eyelids, cheeks, nose, and lips. Although there is always a chance it could become serious, basal cell cancer usually does not spread. Most cases are easily treated and totally cured.

Squamous Cell Cancer

Squamous cell cancer occurs most frequently on the skin exposed to sunlight over long periods of time. These skin areas include the head, neck, backs of the hands and tops of the forearms. This type of skin cancer tends to develop where maximum exposure to radiation occurs—forehead, cheeks, nose, lower lip, and tops of the ears. And it usually develops in areas where the skin has been damaged by the sun—areas with blemishes or sun freckles. The blemishes develop into rough, scaly patches with small areas of open wound that do not heal. They eventually grow into larger wounds with crusts. This type of cancer can be removed with a good chance of total cure, if caught in time. It is most dangerous if it occurs on mucous membranes such as on the lip.

Malignant Melanoma

Malignant melanoma is a rare type of skin cancer, but it is the most serious of the skin cancers. It often shows itself as a mole or pigment spot that begins to bleed, grow, or

change its colour, shape or texture. It usually spreads if not treated in the early stage. Evidence linking malignant melanoma with exposure to sunlight is much less clear than for the other types of cancer. However, researchers have recently recorded a sharp rise in melanoma cases in Canada and other parts of the world. There is concern that this increase may be due partly to the public's changing values about sun tanning. Brief intense exposure to strong sunlight appears to increase the risk of malignant melanoma in people who are not used to strong sunlight. If caught early, malignant melanoma can be treated and cured. If treatment is delayed, it is fatal.

4. WHAT FACTORS AFFECT A PERSON'S RISK?

Four main factors influence the risk of skin cancer:

- skin pigment and ability to tan
- heredity
- exposure to chemicals
- amount of exposure to sunlight

Skin Pigment and Ability to Tan

Ultraviolet radiation from sunlight affects everybody's skin to some extent, but the skin's response varies widely from person to person. Peoples' sensitivity to the sun varies according to the amount of pigment in the skin and the skin's ability to tan.

Ultraviolet radiation causes tanning in two different ways: by immediate tanning and by delayed tanning. Immediate tanning causes the skin to darken in response to long-wave ultraviolet radiation. This darkening begins during the period of exposure, but fades within a few hours or days. The amount of tanning increases according to the skin's natural darkness and previous amount of tanning. Immediate tanning, however, provides very little protection against ultraviolet radiation.

Delayed tanning occurs two to three days after exposure to either long-wave or sunburn ultraviolet radiation. It lasts from several weeks to months, and is maintained by repeated exposure to sunlight. With delayed tanning, the skin increases its production and distribution of dark pigment. The skin also becomes thicker. These changes can follow sunburning or develop gradually over a long period of repeated brief exposures to sunlight. The skin's pigment and increased thickness provide protection against ultraviolet radiation.

Some people burn easily after the first hour of sun exposure following winter or any period away from the sun. Other people, especially those with dark skin, never burn. This difference in reaction makes it possible to classify skin into one of six different types (see Table 2).

Table 2 - **Classification of Skin Types**

Skin Type	Skin Reaction Following 45-60 Minutes Exposure to Sunlight (after winter or a period of no exposure to the sun)
I	Always burns easily, never tans
II	Always burns easily, tans minimally
III	Burns moderately, tans gradually and uniformly (light brown)
IV	Burns minimally, always tans well (moderate brown)
V	Rarely burns, tans profusely (dark brown)
VI	Never burns, deeply pigmented (black)

The risk of skin cancer from the sun generally follows the same pattern. Darker skinned people have low risk of sun-induced skin cancer. The person most prone to skin cancer caused by sunlight tans poorly and suffers sunburn easily. Intense sunburn in children with fair skin and freckles has been linked to malignant melanoma later in life.

Heredity

For reasons not completely understood, people with Celtic heritage (Irish, Scottish or Northern European) have increased risk of skin cancer from the sun. Genetic diseases that affect the skin can also increase the risk. Albinism, a genetic condition which prevents the production of normal skin pigments, makes the skin sensitive to ultraviolet light.

Exposure to Chemicals

Exposure to certain chemicals can increase the skin's sensitivity to ultraviolet light through a process called photosensitization.

Examples of such chemicals include:

- polyaromatic hydrocarbons
- chemicals from coal tar pitch
- printing chemicals
- certain drugs and antibiotics such as tetracyclines and sulfonamides
- chemicals called psoralens found naturally in certain plants, fruits and vegetables

Antibiotics must be taken internally before the skin becomes sensitive to sunlight. However, simple skin contact with psoralens, which are found in figs, parsnips, citrus plants, or mouldy celery, can cause severe sunburn in some individuals.

Experimental studies show that chemicals called "promoters" can increase the cancer-causing ability of ultraviolet radiation. On the other hand, ultraviolet radiation itself can act as a promoter. In particular, ultraviolet radiation can increase the cancer-causing ability of chemicals from coal tar and pitch.

Amount of Exposure to Sunlight

The damaging effects of ultraviolet radiation accumulate over the years. The risk of developing skin cancer increases with the amount of time spent under the sun and the intensity of radiation. The intensity of radiation varies according to the season of the year, time of day, geographic location, and altitude above sea level.

5. WHAT WORKERS ARE AT RISK?

All outdoor workers potentially exposed to the sun's ultraviolet radiation are at risk, including:

- agricultural workers
- athletes
- brick masons
- construction workers
- farmers
- fishermen
- gardeners
- greenskeepers
- horticultural workers
- landscapers
- lifeguards
- loggers
- maintenance workers
- military personnel
- oilfield wokers
- open-pit miners
- pipeline workers
- police
- postal carriers
- railroad track workers
- ranchers
- road workers
- sailors
- ski instructors
- surveyors

6. HOW CAN THE RISK OF SKIN CANCER FROM SUNLIGHT BE REDUCED?

Skin cancer is the outcome of decades of exposure to the sun. So it is important to be aware of the risks and take precautions under the sun from as early in life as possible.

Approaches to prevent skin cancer include:

- reducing exposure to sunlight
- wearing protective clothing
- using sunscreens on exposed skin
- examining the skin regularly for suspicious spots

Reducing Exposure

Workers should avoid unnecessary exposure to the sun, especially to the intense midday rays between 10:00 a.m. and 2:00 p.m. during the summer. If possible, people should plan outdoor work for early morning or late afternoon, and work in the shade as much as possible. Umbrellas and parasols can protect against the direct rays from the sun. However, sand, snow, ice, and concrete can reflect from 10 to more than 50 percent of the sun's radiation. Sensitive skin may require extra protection against these indirect, reflected rays.

Wearing Protective Clothing

The use of wide brim hats and clothes made from close-knit fabric can protect the skin and scalp from ultraviolet radiation. Although longsleeve shirts and long-legged pants may not be practical in extremely hot weather, they do protect the skin from possibly harmful sunlight.

Using Protective Sunscreens

Workers should apply protective sunscreen on exposed skin before working in the sun, then reapply it during the periods they spend under the sun, as directed by the manufacturer's instructions. Most sunscreens are colourless, invisible, and cosmetically acceptable provided they do not harm clothing or produce adverse skin reactions.

A wide variety of sunscreens are available. They all contain chemical ingredients that weaken the effects of ultraviolet radiation.

The most widely used protective chemicals are PABA (para-aminobenzoic acid) and closely related chemicals such as cinnamates, salicylates, benzophenones, or anthranilates. Some sunscreens contain only one of these protective chemicals. Others may have two or more for greater reliability. Products such as baby oil, cocoa butter, or skin oils that do not have protective chemicals, do not protect against sunburn, skin aging, or skin cancer.

Manufacturers label sunscreens with a sun protection factor (SPF). The higher the factor, the greater the protection from the sun. A SPF of 5 indicates low protection; a SPF above 20 indicates high protection. People with skin sensitive to sunlight should use a sunscreen with a high SPF, possibly in the mid 20s for the face, and 15 to 20 for other areas. A sunscreen's effectiveness also depends upon its ability to withstand heat, humidity and sweat. Most sunscreens are not water-resistant, so people have to reapply them after perspiring or getting wet.

It is important to try a variety of different types of sunscreen to find out which one best suits a particular skin type and activity.

Examining Skin Regularly

People who work under the sun should examine their skin regularly for any unusual changes. The danger signs include any wound, sore, or patch of skin that won't heal or constantly scales, or any growing lump, particularly if brown or bluish in colour. It is important to get medical care for anything that looks suspicious rather than wait until the problem becomes untreatable.

7. CONCLUSION

Skin cancer is an occupational concern for people who work under the sun. The risk, however, may be reduced through awareness of the problem, and by taking simple measures to prevent exposure to the harmful radiation.

For more information, consult the articles listed in the Further Reading section at the end of this publication or contact the Inquiries Service of the Canadian Centre for Occupational Health and Safety.

FURTHER READING

Adams, R.A. Occupational skin disease. New York: Grune & Stratton, 1983. p. 82-98.

Cancer prevention: strategies in the workplace. Edited by C.E. Becker et al. Washington: Hemisphere Publishing Corporation, 1986. p. 99-105.

Dermatotoxicology. Edited by F.N. Marzulli et al. Washington: Hemisphere Publishing, 1983. p. 415-441.

Harmful effects of ultraviolet radiation. Journal of the American Medical Association. Vol. 262, no. 3 (1989) p. 380-384.

Mackie, R.M. et al. Health and the ozone layer. British Medical Journal. Vol. 297 (1988) p. 369-370.

Occupational and industrial dermatology. Edited by H.I. Maibach. 2nd Edition. Chicago: Year Book Medical Publishers Inc., 1987. p. 94-104.

Piver, A. Medical consequences of stratospheric ozone depletion. Canadian Family Physician. Vol. 35 (1989) p. 2283-2284, 2354-2355.

Shmunes, E. Occupational skin cancer. Seminars in Occupational Medicine. Vol. 2, no. 4 (1987) p. 267-274.

OTHER CCOHS PUBLICATIONS DEALING WITH OCCUPATIONAL DISEASES

AIDS—A Summary of the Occupational Health Concern (2nd Edition) (P89-21E)

Acne—A Summary of the Occupational Health Concern (P89-1E)

Allergic Contact Dermatitis—A Summary of the Occupational Health Concern (P88-20E)

Asthma—A Summary of the Occupational Health Concern (P87-7E)

Beryllium Disease—A Summary of the Occupational Health Concern (P89-23E)

Crab Workers' Asthma—A Summary of the Occupational Health Concern (P89-12E)

Farmer's Lung—A Summary of the Occupational Health Concern (P87-5E)

Hepatitis B—A Summary of the Occupational Health Concern (2nd Edition) (P90-4E)

Histoplasmosis—A Summary of the Occupational Health Concern (P88-8E)

Irritant Contact Dermatitis—A Summary of the Occupational Health Concern (P88-16E)

Legionnaires' Disease—A Summary of the Occupational Health Concern (P86-18E)

Lyme Disease—A Summary of the Occupational Health Concern (P89-14E)

Psittacosis (Ornithosis)—A Summary of the Occupational Health Concern (P89-10E)

Q Fever—A Summary of the Occupational Health Concern (P87-12E)

Rabies—A Summary of the Occupational Health Concern (P88-4E)

Raynaud's Phenomenon (White Finger)—A Summary of the Occupational Health Concern (P89-13E)

Toxoplasmosis—A Summary of the Occupational Health Concern (P89-19E)

NOTES